REMARKS

I. Request for Interview

Applicants respectfully request that the Examiner telephone the undersigned prior to reviewing the response so that Applicants can discuss the Amendment with the Examiner.

II. Status of Claims

Upon entry of this amendment, claims 33-51 are pending in the application. Claims 34, 35, 41, 42, 43, 47, 49, and 51 have been amended in order to expedite prosecution of the application and advance the case toward allowance. Claim 52 has been added in order to further clarify the invention.

Claims 34, 45, 41, 43, 49, and 51 have been amended to correct informalities noted by the Examiner. Claims 42, 45, and 47 have been amended to clarify the scope of the invention. Support for these amendments is found throughout the specification as filed, in particular, at paragraph 183 of the published application 2005/0044585. Support for new claim 52 is found in paragraph 6 of the published application 2005/0044585. Thus, no new matter was added by this amendment and entry of the amendment is respectfully requested.

III. Claim Objections

The Examiner has objected to claims 34 and 36 for informalities. As suggested, claim 34 has been amended to recite "comprising said transgene" and claim 35 has been amended to make the term in the preamble consistent with that in the last clause.

Withdrawal of the objection is thus respectfully requested.

IV. Nonstatutory Obviousness-type Double Patenting

A. Claims 33-51: In view of U.S. Pat. No. 6,084,153

Claims 33-51 have been rejected for non-statutory obviousness type double patenting as being allegedly unpatentable over claims 5 and 9 of U.S. Pat. No. 6,084,153. Applicants continue to respectfully traverse this rejection and its supporting remarks.

Claim 5 of U.S. Pat. No. 6,084,153 is directed to a genetic construct comprising a *Brassica* turgor gene-26 promoter element operably associated with a nitrogen assimilation/metabolism enzyme coding sequence. Claim 9 of U.S. Pat. No. 6,084,153 is directed to a method for producing a plant regenerated from plant cells containing a promoter which is inducible under osmotic stress conditions, comprising regenerating a plant cell containing a promoter which is inducible under osmotic stress conditions, thereby producing a plant, wherein the plant cell was transformed with a genetic construct comprising a *Brassica* turgor gene-26 promoter element operably associated with a nitrogen assimilation/metabolism enzyme coding sequence. Presently pending claims 33 to 35 are directed to a transgenic plant comprising elevated levels of barley alanine transferase in the root epidermis, wherein the transgenic plant comprises a transgene, wherein said transgene comprises SEQ ID NO: 2 operably linked to SEQ ID NO: 1, seeds of such a plant, and methods of generating such a plant. The other presently pending claims are directed to methods for preferentially producing alanine aminotransferase in the root epidermis of a plant, increasing nitrogen use efficiency of a plant, and increasing biomass of a plant. Both claim 5 and 9 of U.S. Pat. No. 6,084,153 fail to teach transgenic plants comprising SEQ ID NO: 2 operatively linked to SEQ ID NO: 1. Both claims also fail to teach use of a promoter to preferentially produce AlaAT in the root epidermis of a plant and to increase the nitrogen use efficiency and biomass of a plant.

Thus the presently pending claims are patentable in view of claims 5 and 9 of U.S. Pat. No. 6,084,153. However, in the interests of expediting prosecution, Applicants have filed a terminal disclaimer, which is enclosed herewith. Both the instant application and the cited patent

are assigned to a common assignee, the University of Alberta, and therefore a terminal disclaimer to overcome non-statutory obviousness type double patenting is available under MPEP § 804.02(II).

B. Claims 42, 44-48 50 and 51: In view of No. 11/644,321

Claims 42, 44-48 50 and 51 have been provisionally rejected for non-statutory obviousness type double patenting as being unpatentable over claim 22 of copending Application No. 11/644,321. In particular, the Examiner alleges that the construct of claim 22 directed to a construct comprising a monocot antiquitin promoter operably linked to a nucleic acid encoding AlaAT renders obvious the instant claims directed to transforming a plant with such a construct to produce a transformed plant and in addition, the copending application teaches that the rice antiquitin promoter is a homologue of the btg26 promoter taught in the instant application. Applicants respectfully traverse this rejection and its supporting remarks.

Applicants respectfully disagree with the Examiner's characterization of the provisionally rejected claims. The rejected claims are not simply directed to transforming plants with constructs to produce a transformed plant; the claims are directed to methods for the increasing the nitrogen use efficiency or biomass of a plant by expressing a construct to produce elevated levels of alanine aminotransferase.

Applicants fail to see how a construct comprising a monocot antiquitin promoter operably linked to a nucleic acid encoding AlaAT could render obvious claims to methods for increasing nitrogen use efficiency or biomass of a plant. Knowledge of a root epidermis promoter operatively linked to an AlaAT fails to teach one of skill in the art anything about whether expression of the such a construct in plant will increase nitrogen use efficiency or biomass of a plant.

Further, under § MPEP 804(I)(B), if the provisional double patenting rejection is the only rejection remaining in the earlier filed of two pending applications, the Examiner should withdraw the rejection and permit the earlier-filed application to issue as a patent without a terminal disclaimer. In view of the remarks in this response, Applicants believe that the provisional

obviousness-type double patenting rejection is the only remaining rejection and therefore should be removed.

Withdrawal of the above rejections is thus respectfully requested.

V. Rejection under 35 U.S.C. § 112, second paragraph

Claims 41, 42, and 51 have been rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for the term "has a nucleotide sequence of." Applicants have amended claims 41, 42 and 51 to recite "has the nucleotide sequence of," which should address the objection. Withdrawal of the rejection is thus respectfully requested.

VI. Rejection under 35 U.S.C. § 103

Claims 42, 44-48, 50 and 51 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Coruzzi et al. (U.S. Patent 5,955,651) in view of Muench et al (1994), and Suzuki et al. (January 1993, Plant Molecular Biology 21: 109-119).

Applicants respectfully traverse this rejection and its supporting remarks.

Even after *KSR*, a *prima facie* case for obviousness still requires that the combined references teach all elements of the invention and that there is a reasonable expectation of success.

A. Missing element

Obviousness requires that the combined references teach all elements of the invention. Claims 42, 44-48 50 and 51 are directed to methods for increasing nitrogen use efficiency of a plant and methods for increasing biomass of a plant. However, none of the cited references either alone or in combination teaches that elevated levels of AlaAT in the root epidermis would increase nitrogen efficiency and biomass of a plant. The cited references fail to teach the step of expressing a construct comprising nucleic acid encoding AlaAT operatively linked to a root epidermis promoter in the plant to produce elevated levels of barley alanine aminotransferase preferentially in

the root epidermis in order to increase nitrogen use efficiency, as set forth in claim 42-46, or the step of expressing a construct comprising nucleic acid encoding AlaAT operatively linked to a root epidermis promoter in said plant to produce elevated levels of alanine aminotransferase preferentially in said root epidermis in order to increase biomass, as set forth in claims 47-51. As such, the combination of Coruzzi et al, Muench et al., and Suzuki et al. do not teach all of the elements of the claimed invention.

B. No reasonable expectation of success

Even if the combined references together taught all elements of the claimed invention (which is denied), the claimed invention is nonobvious. Prior to this invention, there was no reasonable expectation of success that elevated levels of AlaAT in the root epidermis would increase nitrogen efficiency and biomass of a plant. A Declaration under 37 C.F.R. § 1.132 from Dr. Jean Kridl provided herewith supports this assertion.

As of the date of filing of the invention, it was not even clear that AlaAT was a part of the nitrogen cycle. As noted in the attached Declaration, unlike aspartate and asparagine biosynthesis, alanine biosynthesis is not commonly regarded as a core part of the nitrogen cycle. It is telling that Coruzzi describes the whole nitrogen cycle extensively in U.S. Patent No. 5,955,651 but does not mention alanine aminotransferase or alanine in any context. Further, as explained in the Declaration, alanine in plants was known to increase under hypoxic and anaerobic stress conditions but not under nitrogen stress. In fact, in Good and Crosby (*Plant Physiol.* (1989) 90:1305-1309), an anaerobically-induced isoform of AlaAT in barley, AlaAT-2, was shown to increase under different levels of hypoxia with activity increasing with lower levels of oxygen, while this induction was not affected by the levels of nitrate available to the plants in the media. The gene encoding the anaerobically-induced isoform of AlaAT was cloned from barley and was used in the experiments described in the present application.

Furthermore, given the existing data regarding over-expression of other enzymes involved in amino acid biosynthesis, one of skill would not expect that transgenic plants exhibiting

enhanced nitrogen and metabolism could be produced by over-expressing barley AlaAT. None of the published results of studies over-expressing amino acid biosynthetic enzymes have described any effect on nitrogen assimilation. In fact, as described in the Declaration, in many circumstances over-expression of these enzymes led to unhealthy plants.

Finally, in light of the general knowledge in the art regarding the enzymatic action of AlaAT, one could not have reasonably expected that over-expression of AlaAT would enhance nitrogen assimilation. Since AlaAT is a freely reversible enzyme, as of the priority date, one of skill in the art would not have known whether AlaAT expressed transgenically would function in the forward direction to recycle glutamate and alpha ketoglutarate or in the reverse direction. Any enzyme that catalyzes the conversion of glutamate to alpha-ketoglutarate or the reverse reaction will have an unknown impact on the entire nitrogen assimilation and utilization pathway as shown by Coruzzi in Fig. 1. Any such enzyme could essentially "short circuit" the nitrogen assimilation pathway by competing for substrates with key enzymes in the nitrogen assimilation pathway, AspAT, GS, and GOGAT. One of skill in the art could not have predicted whether such a short circuiting would have negatively or positively affected the cycle. In addition, alanine has been shown to exhibit feedback inhibition of the GS enzyme (a core enzyme in the nitrogen cycle) in bacteria (see, *e.g.,* S.-H. Liaw et al. *PNAS* (1993) 90:4996-5000). Alanine has also been shown to inhibit one GS from plant at least slightly (see, T. D. O'Neal and K. W. Joy *Plant Physiol.* (1975) 55:968-974). Thus, one of skill in the art would not have had a reasonable expectation of success of the claimed methods, as they would have expected that over-expression of alanine would have affected GS activity which, in turn, would interfere with nitrogen assimilation and utilization.

Thus in light of what was known in the art regarding AlaAT as of the date of filing of the application, one of skill would not have had a reasonable expectation that over-expression of AlaAT in plants would increase nitrogen assimilation.

For at least the above reasons, the Examiner has failed to make a *prima facie* case for obviousness. Withdrawal of the rejection is respectfully requested.

VII. Conclusions

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the event the U.S. Patent and Trademark office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing docket no. 595792000420. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Dated: October 31, 2007

Respectfully submitted,

By Michael R Ward

Michael R. Ward
Registration No.: 38,651
MORRISON & FOERSTER LLP
425 Market Street
San Francisco, California 94105-2482
(415) 268-6237